HORSESHOE POND RESTORATION PROJECT
WETLAND DELINEATION REPORT

POINT REYES NATIONAL SEASHORE

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1.0 INTRODUCTION

This report describes the methods and results of a delineation of wetlands within in the Horseshoe Pond Restoration Project (Project) area. This Project intends to restore a natural hydrologic process to an historic lagoon ecosystem through removal of a dam and spillway within Point Reyes National Seashore (Seashore/PRNS), a unit of the National Park Service (NPS). The goal of the study was to map and describe wetlands within the project area according to methods outlined by the United States Fish and Wildlife Service (USFWS) Cowardin Wetland Classification System (Cowardin et. al. 1979). The NPS has identified this method for delineation of wetlands subject to alteration within NPS lands through Directors Order # 71. The Project site lies within the coastal zone and is subject to a wetland assessment on the part of the California Coastal Commission (Coastal Commission). The Coastal Commission uses the Cowardin Wetland Classification System for regulatory purposes.

1.1 PURPOSE AND NEED

Restoration of aquatic and dune habitats have been identified as high priority objectives by PRNS in both the General Management Plan (1980) and the Resource Management Plan (1990). Funding has been obtained through the Dam Safety Program of the National Park Service and the Point Reyes National Seashore Association to restore Horseshoe Pond to its original, historic function as a coastal lagoon. The intent of this Project is to return a natural hydrologic regime to the site through removal of an earthen dam and associated concrete spillway at the base of the pond. Deconstruction of these structures will allow for the enhancement of periodic tidal exchange during winter months.

Prior to dam construction, Horseshoe Pond was one of few coastal lagoons located along the Point Reyes peninsula. Dammed sometime between 1943 and 1952 by the operators of D Ranch, waste from the dairy barns was channeled downhill into the pond for several years. Additionally, large numbers of dairy cows exploited the site for watering and loafing. Although D Ranch was decommissioned in 1998, the dam and subsequent degradation of the site has left an impaired ecosystem. Restoration will return both aquatic and dune ecosystems to PRNS by alleviating several existing conditions:

- The earthen dam has significantly altered natural flow regimes at Horseshoe Pond, impeding both natural outflow from the pond and inflow from the ocean during storm and high tide events.

- Nutrient overloading into the system has resulted in eutrophic conditions, indicated by massive algal blooms and wide variances in dissolved oxygen concentration. Periods of anoxia killed several hundred three spine-stickleback in the spring of 2001.

- Up until January 2002, the three-spine stickleback (*Gasterosteus aculeatus*) was the only fish species in Horseshoe Pond, presumably because other fish species were eliminated by previous anoxic events and the concrete spillway prevented upstream

migration of marine fish. Previously, fish that tried to move up into Horseshoe Pond become trapped in ponded water between the beach and spillway and later expired when the water dried up. Since wash-out of a section of the dam in January 2002 during an extreme high water event, staghorn sculpin (*Leptocottus armatus*) and topsmelt (*Atherinops affinis*) have been documented within the Pond, indicating movement of marine fish into the site. How the concrete spillway will affect fish movement during periods of lower water levels in the summer and fall remains unknown.

- Upland vegetation and invasive dune species, including iceplant and European beach grass, have replaced rare native dune habitat.

- The quarry, ranch roads, earthen dam, and concrete spillway associated with Horseshoe Pond are blights on the landscape, degrading aesthetic and visual resources of the PRNS. Miscellaneous debris around the dam, left over from the ranching operation, contributes to these impacts.

In addition to meeting the Seashore's coastal habitat restoration objectives, this project will also complement other restoration projects currently in progress at the Seashore. These projects include the Coastal Watershed Enhancement Project, the Giacomini Wetland Restoration Project, and the Abbotts Dune Restoration Project. Furthermore, assessment and monitoring protocols developed during the course of this project will be adopted by the Coastal Watershed Enhancement Project, the Giacomini Wetlands Restoration Project, and future tidal wetland restoration projects at the Seashore.

1.2 PROJECT SUMMARY

Restoration of Horseshoe Pond under the preferred alternative, as outlined in the Point Reyes National Seashore (PRNS) Draft Environmental Assessment (2002), would include removal of features associated with the dam and spillway that prevent the natural hydrologic process. The project will facilitate improved tidal exchange and movement of aquatic species in and out of the system. Construction activity along the dam facility would consist of two restoration components. First, the concrete spillway would be removed at the current outflow of the pond. PRNS maintenance staff would complete the work using heavy machinery, accessing the site from the road leading down from the ranch and across the front of Horseshoe Pond. The concrete spillway would be broken up and completely removed from the site, including all reinforcing rip-rap material. Earthen material adjacent to the spillway would be dug out and completely removed from the site, pending National Historic Preservation Act (NHPA) Section 106 compliance. Second, the historic channel at the west end of the dam will be redeveloped by removing a 500 foot-by-12 foot section of the dam. The historic channel was once a wide, unvegetated sand flat that connected the pond to the beach. This area has since been colonized by saltgrass (*Distichlis spicata*), rush (*Juncus lesueurii*) and *Scirpus pungens* and will need to be partially cleared to recreate the channel. The central portion of the dam may be lowered to historic levels and cleared of established upland vegetation. The remainder of the earthen berm extending from the spillway to the current channel will be left intact in

order to preserve a historic Miwok Indian midden site. Deconstruction may be adjusted based on archeological surveys in conjunction with the Sonoma State University Anthropological Studies Center and the Federated Indians of Graton Rancheria, Inc.

Under this preferred alternative, a considerable amount of material would be removed from the ocean outlet of Horseshoe Pond. Park maintenance staff would retain this material on site to rehabilitate the quarry and close out the ranch road leading down to Horseshoe Pond from D Ranch. Additional topsoiling, revegetation, and erosion control measures would be taken to rehabilitate these still-scarred sites.

Two abandoned waste ponds have been identified and assessed as sites for restoration enhancement to offset potential impacts to California red-legged frog habitat.

2.0 METHODS

A wetland survey was conducted on August 17th and September 4th 2001 by biologists Amy Parravano, David Williard, and David Press, in an effort to map and characterize wetlands within the Horseshoe Pond Restoration Project (Project) area. Wetlands were characterized and delineated according to the USFWS Cowardin Wetland Classification System (Cowardin et.al. 1979). A wetland assessment was performed by collecting pertinent data, evaluating wetland criteria, and classifying each wetland type. Wetland boundaries were mapped using GPS.

In addition to a wetland survey and mapping effort, vegetation was characterized and classified. Completed field data forms with wetland and vegetation data are provided in Appendix A.

2.1 WETLAND ASSESSMENT

The Cowardin Wetland Classification System assesses wetlands according to three wetland criteria: hydrophytic vegetation, hydrology, and soils. Once a wetland assessment was complete, wetlands were classified according to the Cowardin System. A site must meet one of the three wetland criteria in order to be classified as a wetland.

2.1.1 Wetland Data Collection

Hydrophytic vegetation, hydrology and hydric soil data were collected while performing field reconnaissance and prior to classifying and mapping wetlands.

Hydrophytic Vegetation Data Collection

Hydrophytic vegetation cover was estimated for each potential wetland. The wetland indicator status was identified for all plant species using the 1996 Draft USFWS National List of Plant Species that Occur in Wetlands. The indicator status is used to determine the probability that a specific plant is found in a wetland habitat. Indicator categories as defined by U.S. Army Corps of Engineers (USACE) Delineation Manual (1987) are shown on Table 1.

Plants categorized as Obligate (OBL) and Facultative Wetland (FACW) species are more commonly adapted to saturated soil conditions within the Seashore and may indicate that wetland conditions are present. If there was any uncertainty regarding the amount of hydrophytic vegetation cover, vegetation data was initially collected as described in the section below, titled "Vegetation Sampling". Wetland indicator status was then recorded for each taxa, from which the sum of hydrophytic vegetation cover was calculated.

Table1. Definition of Wetland Indicator Categories (USACE 1997)

Wetland Indicator Category	**Definition**
Obligate (OBL)	Plants that almost always occur (>99% probability) in wetlands.
Facultative Wetland (FACW)	Plants that usually occur (>67-99% probability) in wetlands.
Facultative (FAC)	Plants that are equally likely to occur in wetlands or uplands (33-67% probability).
Facultative Upland (FACU)	Plants that sometimes occur (<33% probability) in wetlands.
Upland (UPL/NI)	Plants that rarely occur (<1% probability) in wetlands

Hydrology Indicator Data Collection

Signs of wetland hydrology were identified and documented for potential wetland sites. Hydrology indicators include standing water, standing water depth, soil saturation or oxidized root channels in the upper 12 inches of soil, drift lines, sediment deposits, water marks/water stained leaves, and drainage patterns. Definitions for hydrology indicators follow the USACE Delineation Manual (1987). *Standing water* was recorded in inches for the average depth found within the wetland. If standing water was not present, the soil was checked for *saturation* and *oxidized root channels* in the upper 12 inches. Examination of these indicators required digging a soil pit to a depth of 16 inches, observing the level at which water stands in the hole, and recording the presence of oxidized root channels. *Drift lines* are composed of debris such as branches, leaves, and stems that are moved by water and deposited on banks or entangled around vegetation. *Sediment deposits* are thin layers of organic matter or minerals found on vegetation after inundation. When the deposits are primarily organic, the detritus may become encrusted on or slightly above the soil surface. *Watermarks* and *water stained leaves* are bands of fine silt or sediment that have formed around tree trunks or leaves following inundation. *Drainage patterns* within wetlands consist of surface evidence of drainage flow into or through an area. These patterns include scouring of the soil surface, which is evident around roots or persistent vegetation. Special hydrogeomorphic features such as channels, seeps, basins, dune swales are also included in this category. Topographic position must be considered when applying this indicator, as these patterns may occur in upland areas following periods of heavy precipitation.

Hydric Soil Data Collection
In the lowest topographical area of the wetland, a 1½ by 12-inch soil core was removed using a Hoffer™ 21-inch soil probe. The matrix and mottle colors were identified using the Munsell™ Soil Color Chart (2000). The matrix color is the predominant soil color and mottles are contrasting color spots within the soil matrix. The soil chart characterizes soil color according to hue, value, and chroma. Hue measures the overall soil color, value describes the lightness or darkness of the hue, and chroma describes the amount of grayness in the color (USACE 1987).

The soil core was then inspected for hydric indicators including mottling, gleyed coloration, oxidized rhizospheres, sulfidic odor, high organic content and organic streaking. Hydric soils form when soils remain inundated or saturated for long periods during the growing season. Waterlogged soils create anaerobic conditions, which changes the chemistry of the soil, causing a visual change in soil coloration. In general, under periods of extended inundation soils will turn gray or bluish. In cases of shorter inundation or varying saturation, orange or reddish mottles will appear in the soil matrix. A less reliable indicator is the presence of oxidized root channels or rhizospheres that form reddish marks in the soil surrounding fine plant roots.

2.1.2 Wetland Criteria Evaluation
After data on vegetation, hydrology, and hydric soil were collected, wetland criteria, as defined by the USFWS Cowardin Wetland Classification System, were evaluated to determine whether a wetland was present. A site is considered a wetland if one or more of the three wetland criteria is met. These criteria include presence of hydrophytic vegetation, signs of hydrology, and hydric soil indicators. If at least 50 percent of the wetland is covered with hydrophytic vegetation (FACW or OBL) the first criterion is considered fulfilled. An area meets hydrology criteria if the site is inundated or saturated for more than ten consecutive days some time during the year. The presence of one or more visible hydrology indicators may also meet wetland hydrology criteria. The third wetland criterion is met if soils exhibit any hydric indicators. Soils may be considered hydric if they are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor growth and regeneration of hydrophytic vegetation. Soils formed under these conditions generally display hydric indicators, as listed above, under the "Hydric Soil Data Collection" section.

2.1.3 Wetland Classification
If a site was determined to be a wetland after collecting data and evaluating wetland criteria, it was classified according to the Cowardin System. The hierarchical structure of this classification system is composed of three levels: System, Subsystem, and Class. The systems are subdivided into five subsystems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine. Systems and subsystems have similar hydrological, geomorphological, chemical, and biological mechanisms within each of their respective categories. Dominant plant life form and physiography and composition of the substrate describe the Class level. Water Regime Modifiers apply to Classes. This category considers specific hydrologic conditions that affect the periodicity and duration of inundation. Special

Modifiers describe wetlands that have been created or highly modified by human activities. This includes wetlands that are diked or impounded, excavated, farmed, drained or ditched, grazed by cattle, filled with artificial substrate, or dammed by beavers. A detailed chart illustrating the Cowardin classification hierarchy is provided in Appendix H.

Once a wetland was evaluated and classified, it was assigned a mapping code developed by the National Wetlands Inventory (NWI), a division of USFWS. This code is derived from the USFWS Cowardin Wetland Classification System. A description of mapping codes is provided in Appendix G.

In addition to wetland classification, alteration of wetland function through disturbances or artificial structures was also documented for each wetland. This information was recorded in detail in the comment section of the field data form.

2.2 WETLAND MAPPING

Wetlands were typically mapped on the ground using Trimble GPS, which collected ground data at +/- two to sub-meter accuracy. Each polygon was mapped as a "wetland" feature. The Trimble GPS was uploaded with a wetlands data dictionary for classification of each polygon. The data dictionary included fields for the hierarchical structure of the Cowardin Wetland Classification System: System, Subsystem, Class, Water Regime modifier, and special modifiers. Prior to mapping, the polygon was classified according to its Cowardin Wetland Type, and assigned a corresponding NWI mapping code. For an explanation of these codes, refer to Appendix G. These GPS data were downloaded daily onto a PC using Trimble Pathfinder Office 2.8 software for data transfer and storage. After downloading, the geographical data and data dictionary contents were exported into ArcView GIS software. These data were then mapped as wetland polygons with associated attributes that were stored in a theme table. Polygons that could not be mapped from the ground, due to impassable terrain, were digitized in ArcView GIS using digital orthoquads as a backdrop.

2.3 VEGETATION SAMPLING AND CLASSIFICATION

Vegetation sampling methods followed the United States Geological Survey (USGS)/NPS Vegetation Mapping and Accuracy Assessment protocol with slight modifications to capture specific wetland vegetation attributes. A comprehensive species list was compiled for each entire wetland polygon; no sub-sampling of polygons was conducted. Percent vegetation cover for each species was determined by visually estimating areal cover of each plant species. Percent cover of each plant taxon was documented as a cover class (<1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, >75%). Because vegetation layers overlapped, combined cover could exceed 100 percent.

The wetland indicator status was identified for all listed species using the 1996 Draft USFWS National List of Plant Species that Occur in Wetlands.

The final step in vegetation sampling was to key the wetland plant community to an Alliance and Association, using a dichotomous plant community key developed by Todd Keeler-Wolf (1999). For wetlands that could not be classified according to the key, alternative vegetation types were suggested in the comment field of the field data form. Unknown plants were collected and identified if possible.

3.0 PROJECT SETTING

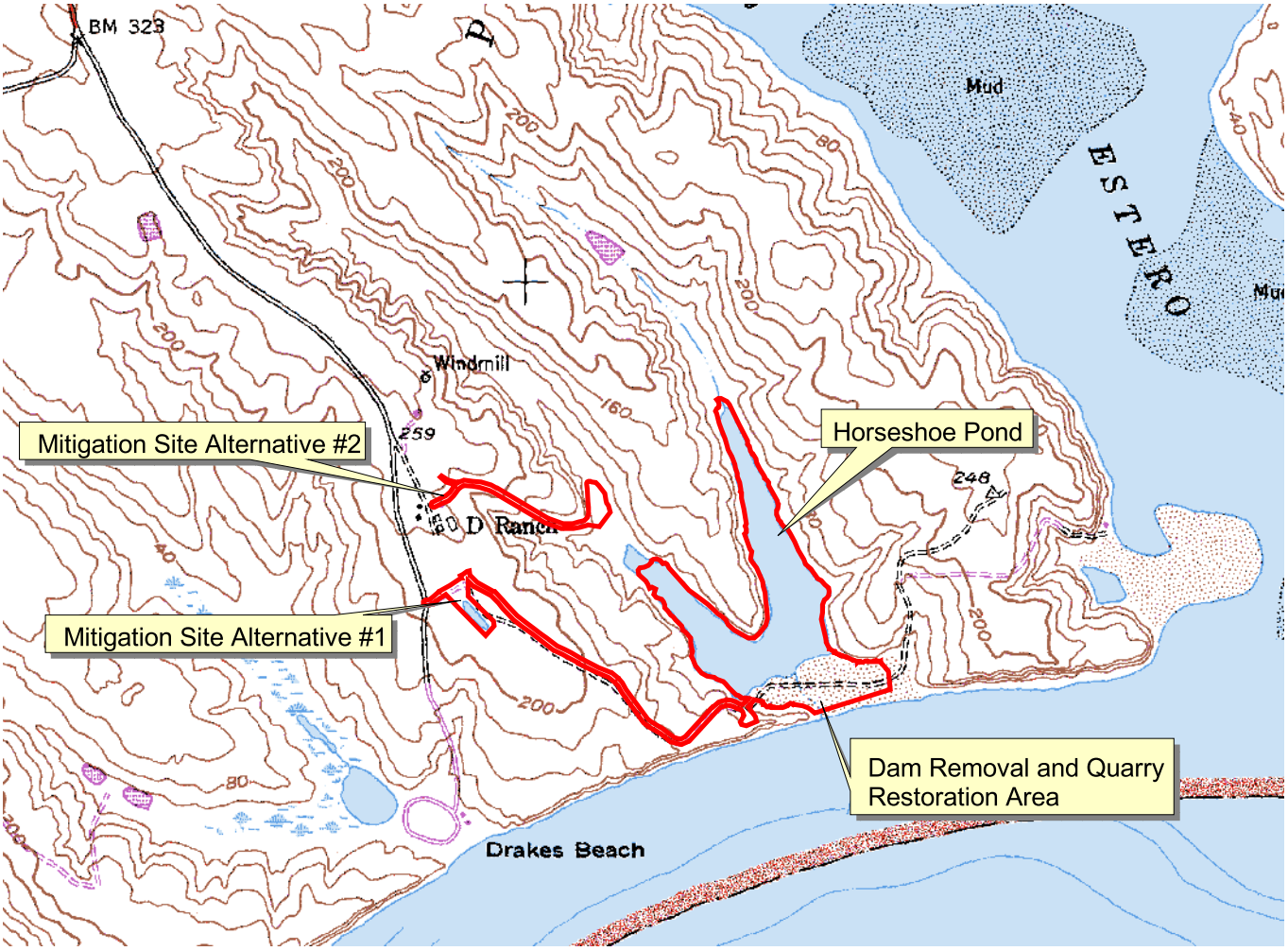
Most restoration activities will occur along the oceanward shoreline of Horseshoe Pond. An earthen levee supporting a historic roadway extends along this shoreline, separating the pond from Drakes Beach (Figure 1). A concrete spillway is present on the eastern end of the levee, which crosses a pond outlet to the ocean. A portion of the roadway washed out in the mid-1980s, allowing high tide and storm events to extend up the beach to the current spillway location. During high tide and storm events, tidal water has been observed exceeding the top of spillway, spilling into the main body of the pond. During El Niño storms of 1997-1998 and during storms in fall of 2001, portions of the dam breached due to freshwater outflow, creating an opening adjacent to the spillway. This opening has allowed for an increased exchange of salt and freshwater during storm and high tide events. Salinity readings fluctuate from low in the winter to higher in the summer (Table 2). Salts are diluted by upland runoff during the winter and concentrated by evaporation during the summer.

The Horseshoe Pond Project Area includes the main construction access road to the Horseshoe Pond levee, an abandoned waste pond and surrounding area just south of the D Ranch building complex, Horseshoe Pond and its surrounding shoreline, the oceanward side of the levee and spillway, a former waste pond on the north end of the western arm of the pond and an associated construction access road that leads southeast from the D Ranch complex to the abandoned pond.

Project Site History

The historic D Ranch complex was built sometime between 1862 and 1871and became part of Charles W. Howard's holdings through the Shafters/Howard Partition of 1867-70. The Shafters/Howard Partition divided parcels on the Point Reyes Peninsula between Oscar L. Shafter, James M. Shafter, and Howard. Later, after changing ownership several times, Bill and Alice Hall bought the ranch in 1940 after living at the complex and leasing the property from owner Quinto Condoni since 1936. The Halls sold the dairy business to son and daughter Vivian and Bill, Jr. in the late 1940's, although it was Vivian and husband Rudolph Horick who operated the dairy from approximately 1964 to 1998. In 1971, PRNS purchased the ranch and established a 20-year lease and occupancy reservation agreement with the Hall/Horick family. Upon Mr. Horick's passing in 1980, Mrs. Horick became the sole ranch operator until her death in 1998. The dairy operation was discontinued following her death in 1998.

Figure 1. Location of Horseshoe Pond Restoration Project Proposed Project Area.



800 0 800 1600 Meters

Delineation Study Area

From USGS 7.5 Minute Quadrangle
Drakes Bay, California

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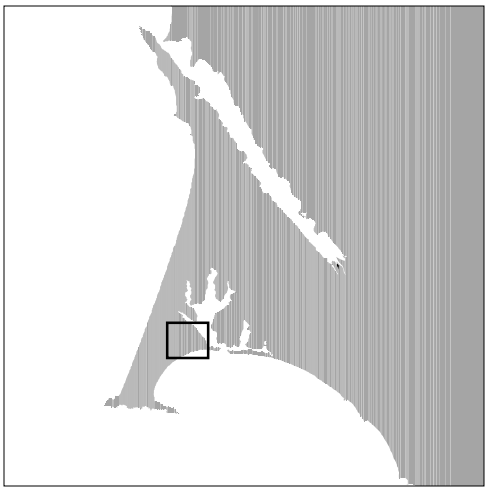

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Figure 2. Aerial Photograph Illustrating Historic Outflow of Horseshoe Pond (PRNS Archives 1943)

Aerial photos from 1941 and 1943 reveal that the historic outflow of Horseshoe Pond existed in the southwest corner of the pond, opposite the current channel out onto Drakes' Beach (Figure 2). Visible in these photographs is a broad, sandy channel set against the west slope of the drainage. A large plume of sand is seen washed far into the pond from the channel. From these historic photos, the current channel on the west side of the pond appears to be dominated by exterior dune vegetation and interior wetland vegetation. The 1941 photograph, taken in December, shows a small pond set just behind the foredune.

Between 1943 and 1952, the Hall/Horick family built a road leading down from the ranch complex, across the front of Horseshoe Pond, and up a side drainage to the east pastures and a hunting cabin on the shore of Drakes' Estero. This construction project effectively cut off regular tidal exchange with Drakes' Bay. A bridge/culvert complex was developed to allow pond overflow onto the beach through the historic outflow channel, but the remainder of the historic channel was filled with material provided by a quarry set just west of the pond, along Drakes' Beach. Additional fill was laid along the entire dune barrier extending over to the east side of the pond.

By 1974, the pond had reached its current observed water levels and the historic channel had almost completely filled with vegetation, presumably the same composition of saltgrass (*Distichilis spicata*) and rushes (*Juncus* spp.) present today. At some point prior

to 1974, the culvert/bridge system was removed, perhaps due to failure, and the earthen berm sealed up completely with additional material from the quarry. The pond outflow was relocated to the east side of the pond, where it currently exists. The earthen dam existed in this state until the early 1980s. Storm events and high water levels in the pond began eroding the road and berm around the current outflow of the pond, such that by 1983 a significant portion of the dam had been lost and the remaining road up to the east pastures overlooking Drakes' Estero was only passable at low water. Additional storms in January 1982 and November 2001 may have accelerated this process.

In 1988, the Horick family received funding from the NRCS Agricultural Conservation Program to construct an alternate route to the east pastures. The existing 60-ft concrete spillway was built across the outflow of the pond in the east corner and reinforced with rip-rap. To allow vehicle passage, fill was taken from the adjacent slope and laid down on either side of the spillway, completely sealing off the pond again to tidal exchange.

Water quality conditions in Horseshoe Pond degraded severely during operation of the dairy. Perched on the western edge of the Horseshoe Pond watershed, the D Ranch dairy facility was a threat to water quality conditions in Horseshoe Pond. Liquid dairy waste was dumped into a small holding pond at the head of the west arm of Horseshoe Pond. In a letter to the Park Superintendent dated January 1988, the Sierra Club Marin Chapter expressed concern that "rotting manure carpeted" much of the Horseshoe Pond flood plain below the holding pond and that water flowing down from the ranch complex appeared yellow.

The special use permit under which the D Ranch operated was terminated in 1998, effectively closing the dairy operation. All dairy cows were subsequently removed from the project site and surrounding watershed. The earthen dam and concrete spillway remain in place, although a 15-ft section of material adjacent to the concrete spillway washed out in January 2002. Ocean water now flows into Horseshoe Pond through a constricted opening on extreme high tide and storm events.

Geology and Soils

The Horseshoe Pond watershed lies within the Purisima Formation. Consisting primarily of Tertiary siltstone and sandstone formed during the Pliocene, the Purisima Formation forms the cliffs exposed along the length of Drakes Bay. This area is the type section used by Galloway (1977) to describe the Drakes Bay Formation.

The Purisima Formation represents a shallow, marine shelf depositional environment. Although the Drakes Bay Formation lies on geologic beds dating to the late Miocene in areas, it is overlain only by eolian deposits of sand particles. The formation is somewhat resistant to erosion, but is well exposed along the shoreline cliffs. Marine terraces are also exposed above the cliffs. The valley bottom including the pond, is made up of recent fine grained alluvial fill with a significant organic component.

Drainages leading into and out of Horseshoe Pond are characterized by the soil map unit Humaquepts, seeped. This unit consists of nearly level to sloping, poorly drained soils

occupying small drainageways. Typically, Humaquepts have three to six inches of sod on the surface, which is 50% or more peaty material. Below this is very dark gray or black loam, clay loam, or clay this is constantly wet. Many areas are subject to deposition of material blown from ocean beaches. These areas have a loamy sand surface layer and are loam or coarser in texture in the underlying material. This soil has a water table at or near the surface throughout winter and spring. During summer and fall, the water table is at a depth of two to five feet. The soils are wet as a result of seepage from higher areas. Deep gullies have developed in a few areas as a result of runoff.

Sirdak sand characterizes the substrate in the vicinity of D Ranch buildings (Figure 1). This very deep, somewhat excessively drained soil is found in rolling, dunelike areas, occupying two to fifteen percent slopes. It formed through eolian deposition of sand particles. Slopes are complex. Characteristic vegetation is mainly shrubs and annual grasses. Elevation is 20 to 500 feet. Permeability is rapid, and water-holding capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff potential is medium, and the hazard of wind erosion is high.

Tomales-Sobega complex occurs at nine to fifteen percent slopes (located along the ranch road between the old sewage pond [Proposed Mitigation Site #1] and Horseshoe Pond) and fifteen to thirty percent slopes (between D Ranch and the top of Horseshoe Pond's west arm). This map unit occupies upland habitats. Slopes are complex. Elevation is zero to 800 feet. This unit consists of 50 percent Tomales fine sandy loam and 30 percent Sobega sandy loam. The Tomales soil occurs on convex side slopes, and the Sobega soil occurs near the upper part of convex side slopes. Runoff potential for the complex ranges from medium to very high and the hazard of water erosion is moderate to high. Effective rooting depth is 20 to 40 inches on nine to fifteen percent slopes and 40 to 60 inches on fifteen to thirty percent slopes. The Tomales soil is deep and moderately well drained, with a low water holding capacity. It formed from sandstone-derived material with very slow permeability. The Sobega soil is moderately deep and well-drained. It formed in material derived from coarse-grained sandstone, having moderate permeability and low water holding capacity. Included in this soil map unit are small areas of seeped Humaquepts in drainageways, Sirdrak soils near the lower part of side slopes, Steinbeck soils on side slopes, and small areas of Bayview and Pablo soils on rounded knolls.

The Tocaloma-McMullin complex occupies 30 to 50 percent slopes on upland areas surrounding east and south shorelines of Horseshoe Pond (Figure 1). Elevation is 20 to 200 feet. The complex consists of 40 percent Tocoloma loam and 35 percent McMullin gravelly loam. The Tocaloma soil is on convex side slopes, and the McMullin soil occurs near the upper part of convex side slopes. The Tocaloma soil is moderately deep and well drained. It formed in material derived from sandstone or shale. Typically, the surface layer is grayish brown or brown loam approximately nineteen inches thick. The subsoil is light yellowish brown gravelly loam about 20 inches thick. Fractured bedrock is at a depth of 30 inches. Depth to bedrock ranges from 20 to 40 inches. Permeability of the Tocoloma soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid and the hazard of water erosion is high. The McMullin soil is shallow and well drained. It formed in material derived from

sandstone or shale. Typically, the surface layer is grayish brown gravelly loam about four inches thick. The subsoil is light yellowish brown gravelly loam about fourteen inches thick. Fractured bedrock is at a depth of eighteen inches. Depth to bedrock ranges from ten to 20 inches. Permeability of the McMullin soil is moderate. Available water capacity is low to very low. Effective rooting depth is ten to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

Vegetation

A variety of habitats characterize the Project area (Figure 1), including coastal freshwater and brackish marsh, salt marsh, coastal dune, non-native annual/perennial grassland, native perennial grassland, and scrub. East-facing slopes leading down to the west shoreline of Horseshoe Pond, along the north side of the ranch road leading down to the dam, is dominated by mesic coyote brush (*Baccharis pilularis*) scrub with patches of spreading rush (*Juncus effusus*) and Pacific reedgrass (*Calamagrostis nutkaensis*). Vegetation along the earthen levee impounding Horseshoe Pond is characterized by coyote brush scrub associated with bush lupine (*Lupinus arboreus*), blackberry (*Rubus ursinus*), and Douglas iris (*Iris douglasiana*). Upland slopes surrounding northern and eastern shorelines and along construction access roads are predominantly mixed native perennial and non-native annual grassland with scattered, low-growing coyote brush shrubs, blackberry, and Douglas iris.

Wetland vegetation characterizing a saltmarsh along the oceanward side of the spillway is dominated by salt rush (*Juncus leseurii*) and salt grass (*Distichlis spicata*). Just south of this area, vegetation on the beach is composed of a mix of native coastal sand dune plant species and European beachgrass (*Ammophila arenaria*). West of the beach on the oceanward side of the levee is a brackish marsh dominated by salt rush, saltgrass, and *Scirpus pungens*. Along the pondside shoreline of the levee is also a brackish marsh dominated by *Scirpus pungens*.

Located approximately 650 feet south of the D Ranch building complex is a former waste pond that has been chosen as a potential mitigation site (Site #1) for California red-legged frog. Disturbed vegetation in this area reflects the degraded condition of this site. When this site was initially surveyed during late summer, the waste pond was largely dried up with the exception of two flooded portions with little to no emergent vegetation cover. The soil surface was dry and cracked, covered with mineral salt deposits and weedy, pioneering annual forbs, perennial ryegrass (*Lolium perenne*), and *Lolium multiflorum*. Two additional wet, depressional areas were present just north of the pond basin and adjacent to the construction access road south of D Ranch. A disturbed area dominated by lambsquarters (*Chenopodium album*), associated with annual rabbitsfoot grass (*Polypogon monspeliensis*) and spikerush (*Eleocharis macrostachya*) was situated on the backside of the earthen levee impounding the sewage pond. Immediately adjacent and to the east is a tiny depression at the base of a culvert that crosses the access road. This area was dominated by non-native annual/perennial grassland, composed primarily of mouse barley (*Hordeum murinem*) and perennial ryegrass (*Lolium perenne*). Across the access road is a small rill draining surface flow from D Ranch, down into the culvert at the

bottom of the hill. Vegetation characterizing this wetland was also non-native annual/perennial grassland.

Non-native annual/perennial grassland characterizes the Project area in the vicinity of the D Ranch building complex and along the construction access road leading to a second mitigation site (Proposed Mitigation Site #2) for California red-legged frogs. This site is also an abandoned sewage pond. Vegetation in the pond area consists of predominantly rush with hydrophytic forb and weedy annual components. A seasonal stream occupying a downcut gully runs adjacent to the abandoned pond and drains into the northern portion of the west arm of Horseshoe Pond. The streambed is vegetated mainly by a mix of hydrophytic forbs. For complete plant species lists compiled from the entire Project Area, please see Appendix B.

4.0 COWARDIN WETLAND DELINEATIONS

The Horseshoe Pond Restoration Project area was initially surveyed on 8/17/01 and 9/4/01, following a dry winter. The rainfall total for the year was 60% of normal for this area. The Project area was surveyed again on 12/19/01, following 15 inches of rainfall that occurred during a six-week period, which is twice the normal rainfall for this time of year[1].

This section provides a discussion of each wetland type, listed by NWI mapping code and grouped by four separate sub-sites within the Project area. Each wetland delineation is labeled on corresponding maps with a unique identification code (e.g. 01DP01) and NWI wetland mapping code. A map of all wetlands occurring in the Project area is provided in Figure 3.

An explanation of NWI mapping codes corresponding to each Cowardin wetland classification is provided in Appendix G. A description of the hierarchical structure of the Cowardin Classification System is provided in Appendix H. Plant species lists compiled for each sub-site within the Project area are provided in Appendices C, D, E, and F.

Some of the Palustrine wetlands surveyed did not exhibit a primary wetland indicator, such as presence of over 50% FACW or OBL hydrophytic plant cover, standing water or saturation in the upper 12 inches of soil, or presence of a hydric soil indicator. A discussion of how these wetlands met wetland criteria is included in the following wetland type descriptions. In addition, some of the wetlands that were initially mapped were later rejected as wetlands. These areas are included on the wetland maps and are also discussed in this section.

[1] Long-term rainfall information is collected at PRNS headquarters on Bear Valley Road in Point Reyes, California.

Horseshoe Pond and Oceanward Side of Levee

Palustrine, Estuarine, and Tidal wetlands occur along the south shoreline of Horseshoe Pond, in the vicinity of the pond/beach interface along the dam and spillway (Figure 4). Tidal areas were delineated by the presence of a distinct wrackline. Soil map units characterizing this area are Humaquepts, seeped and Beach. A complete plant species list for this sub-site is provided in Appendix C.

E1UBLh (01DP18) – 35.29 acres

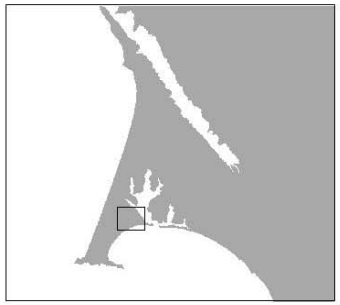
- Estuarine Subtidal, Unconsolidated Bottom, Subtidal, diked/impounded

This classification describes Horseshoe Pond, located just west of the mouth of Drakes Estero along Drakes Beach. The pond is situated in a shallow embayment that once functioned as a coastal lagoon, with seasonal access to oceanic tides. Since construction of an earthen levee (1943-1952) and concrete spillway (1988) along its downstream (seaward) shore, this system currently has partly obstructed yet periodic access to open ocean at high tides and during storm events.

The Estuarine System describes adjacent tidal wetlands with low energy and variable salinity, influenced by oceanic tides and often semi-enclosed by land. The Estuarine System extends upstream and landward, ending where ocean-derived salts measure less than 5.0 ppt during the period of average annual flow. Horseshoe Pond receives freshwater surface runoff, occasional inflow of tidal waters at extreme high tides, and negligible accumulation of salts from historic dairy surface runoff. Salt water flows into Horseshoe Pond from an adjacent Estuarine Intertidal channel (Figure 4; 01DP01) that occasionally overflowed the cement spillway, but now flows around the structure where a small portion of the earthen dam has washed out. Monthly salinity measurements were recorded from Horseshoe Pond, upstream from the concrete spillway, and from the Estuarine channel on the oceanside of the spillway, from 10/23/2000 to 12/10/2001 (Table 2). Salinity readings fluctuated throughout the year, due to evaporation and inundation from oceanic tides and precipitation. Ocean-derived salts averaged 7.0 ppt for the year. Vegetation becomes increasingly less salt tolerant upstream. Due to the earthen dam and concrete spillway limiting exchange with adjacent tidal waters, the System could be classified as Lacustrine at certain times of the year when salinity measurements are less than 5 ppt.

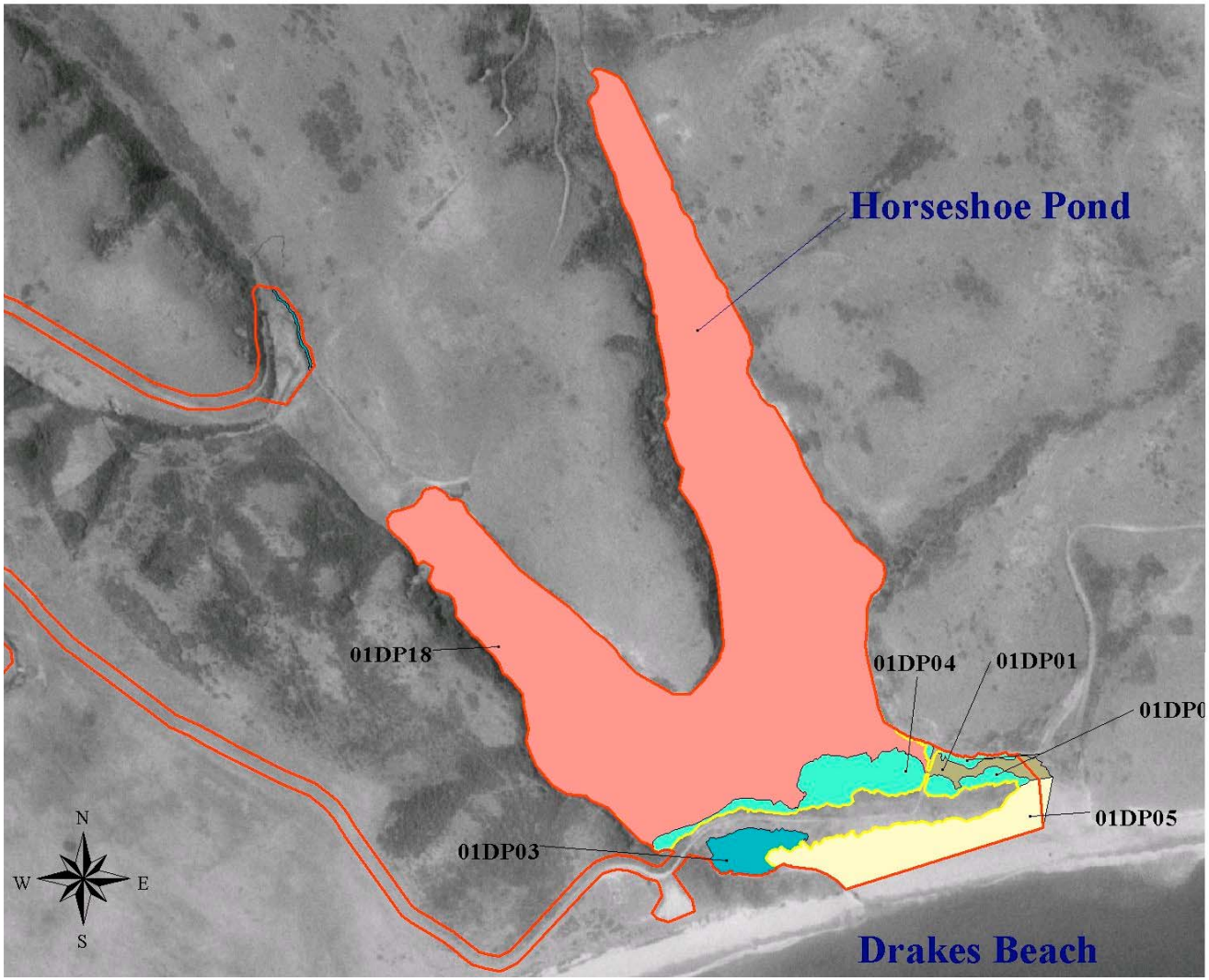
Water covers the substrate throughout the year in all years, although the depth fluctuates from three feet during late summer to six feet at the ordinary high water (OHW) mark. The water regime is classified as subtidal, due to continual submersion. The presence of a 1100 foot-long dam, consisting of a concrete spillway and earthen levee at the pond/beach interface, modifies the lagoon's natural hydrologic function. This structure currently restricts the volume of tidal inflow and freshwater outflow. The special modifier on the Subtidal water regime, "diked/impounded", describes this alteration of wetland function.

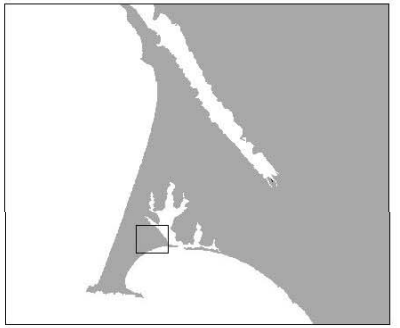
Figure 3. Map of all wetlands occurring within Horseshoe Pond Restoration Project Area

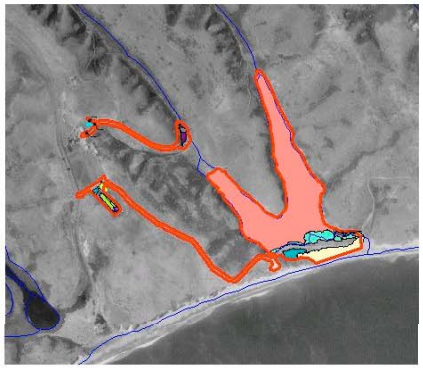


Mit2_area.shp
Delineation Study Area
Hydrography
Cowardin Delineations
E1UBLh
E2EMPh
E2SBPh
M2USP
PEMA
PEMB
PEMBxh
PEMC (considered for classification, but rejected)
PEMCh (considered for classification, but rejected)
PEMH
PUBChx
PUBFhx
PUBHhx
Cowardin Delineations
PEMA
PEMH

Figure 4. Map of Cowardin Wetland Delineations: Horseshoe Pond and Oceanward Side of Dam







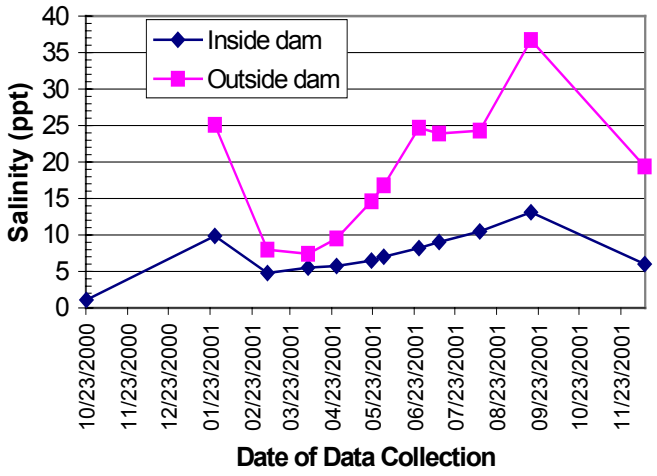
Project Boundary
High Tide Line
Cowardin Delineations
E1UBLh
E2EMPh
E2SBPh
M2USP
PEMCh

0 400 800 1200 1600 Feet

S:\GIS\projects\horseshoe pond\cowardin wetlands

Table 2. Salinity Measurements for Horseshoe Pond and Estuarine Channel

Date	Pond	Channel
10/23/2000	1.1	
1/26/2001	9.9	25.1
3/6/2001	4.8	8.0
4/5/2001	5.5	7.4
4/26/2001	5.8	9.5
5/22/2001	6.5	14.6
5/31/2001	7.0	16.8
6/26/2001	8.2	24.7
7/11/2001	9.1	23.9
8/10/2001	10.5	24.3
9/17/2001	13.1	36.7
12/10/2001	6.0	19.4
Average	7.3	19.1



E2EMPh (01DP02 and 01DP04) – 0.56 acres and 1.94 acres, respectively

- Estuarine Intertidal, Emergent, Irregularly Flooded, diked/impounded

This classification describes three delineations of wetlands occurring on oceanward and pondward sides of the cement spillway. Two of the delineations (01DP02) represent upper banks of an estuarine channel (E2SBPh; 01DP01) on the oceanward side of Horseshoe Pond. Hydrophytic vegetation, which exceeds 50% aerial cover, is strongly dominated by salt grass (*Distichlis spicata*; FACW) associated with salt rush (*Juncus lesuerii*; FACW). Lower areas bordering the channel are dominated by salt grass, while rush dominates areas of higher elevation within the wetland.

The third delineation (01DP04) represents the exposed southern shore of Horseshoe Pond, extending west from the upstream side of the cement spillway to the northwest corner of the pond. The pond's shore is inundated by saltwater that overflows the spillway during high tides and freshwater surface runoff that accumulates in the shallow pond basin. The area upstream of the spillway, along the pond shore (01DP04), has a greater proportion of plant species that can tolerate both saline and freshwater conditions, as compared to the oceanward side of the spillway (01DP02), which supports mostly halophytic species adapted to a more saline environment. The impoundment created by the artificial levee impedes regular mixing of fresh and salt water by obstructing the outflow of freshwater and inflow of salt water to the pond. However, there is a short period of mixing that occurs during overflow of freshwater surface flow from heavy rains and/or high tides that overcome the height of the spillway.

This system is located in the Intertidal zone, defined as an area from extreme low water to extreme high water, including the associated splash zone. The Emergent Class is characterized by erect, rooted, perennial herbaceous hydrophytes present for most of the growing season in most years. The Water Regime modifier is classified as Irregularly

Flooded, where tidal water floods the land surface less often than daily. At high tides, water backs up against the ocean side of the concrete spillway and floods out from the channel and onto these areas for variable periods. Due to wide fluctuations in salinity and hydrology, there is a high diversity of freshwater hydrophytic and halophytic plant species.

E2SBPh (01DP01) – 0.52 acres

- Estuarine Intertidal, Unconsolidated Shore, Irregularly Flooded, diked/impounded

This Estuarine Intertidal channel is located along the south, oceanward side of the cement spillway. This delineation is nested between Estuarine Intertidal, Emergent, Irregularly Flooded intertidal flats (01DP02). The channel is semi-enclosed by land and has sporadic access to the ocean. The Class Streambed describes wetland habitats with less than 75% cover of stones, boulders, or bedrock and less than 30% vegetation cover. The substrate is primarily unvegetated, with the exception of a few scattered pioneering annual and perennial halophytic wetland emergents. The Irregularly Flooded Water Regime modifier indicates that the channel is irregularly flooded by extreme high tides and periodic freshwater overflow from Horseshoe Pond. A "diked/impounded" special modifier describes the levee's influence on the character and function of this wetland habitat. The artificial levee and spillway inhibit regular exchange of fresh and salt water between Horseshoe Pond and oceanic tides.

M2USP (01DP05) – 3.15 acres

- Marine Intertidal, Unconsolidated Shore, Irregularly Flooded

This wetland polygon represents a portion of open, sandy beach, located along the southwestern Project boundary. The inland portion of this wetland is bound by a wrack line representing the high tide line. This line follows along the base of a levee road atop a stabilized dune, which divides the salt marsh channel and associated intertidal flats (01DP01 and 01DP02) from the beach. This wetland is colonized by approximately 15% cover of a variety of coastal sand dune-adapted plant species, including European beachgrass (*Ammophila arenaria*; NI), iceplant (*Carpobrotus edulis*; NI), saltgrass (*Distichlis spicata*; FACW), and American dunegrass (*Leymus mollis* ssp. *mollis*; UPL).

The Marine System consists of open ocean overlying the continental shelf and its associated high-energy coastline. This habitat is exposed to the waves and currents of the open ocean and the water regime is determined primarily by the ebb and flow of oceanic tides. Salinity exceeds 30 ppt. This intertidal marine wetland is bound by the tidal zone and the landward limit of tidal inundation (extreme high water line) and includes the splash zone from breaking waves. The Class Unconsolidated Shore is characterized as having unconsolidated substrate with less than 75% areal cover of stones, boulders, or bedrock and less than 30% areal cover of vegetation other than pioneering plants. The wetland is flooded by tides less often than daily, and is therefore classified as Irregularly Flooded (Cowardin et. al. 1979).

PEMCh (01DP03) – 0.89 acres

- Palustrine Emergent, Seasonally Flooded, diked/impounded

This wetland is situated in a low-lying depression that was once a portion of a historic channel, located on the west end of the dam, that connected Horseshoe Pond with Drakes Beach. An old wrack line runs along the base of the levee, bounding the upstream portion of this wetland. However, this site has not likely been influenced by oceanic tides for more than five years (Press, pers. comm.) and salinity measurements from December 10, 2001 measured 1.4 ppt. Consequently this wetland is characterized as a predominantly freshwater, Palustrine System with emergent vegetation. Vegetation is dominated by plants that occur in brackish habitats at other sites within PRNS. The source of salinity for this wetland is residual ocean-derived salts and salt spray. Dominant plants include salt rush (*Juncus leseuerii*), *Potentilla anserina* ssp. *pacifica*, *Scirpus pungens*, and saltgrass (*Distichlis spicata*). Standing water, at an approximate depth of six inches, is present through winter months. The water table resides at or very near the surface when standing water recedes at the end of the growing season, characterizing a Seasonally Flooded Water Regime. The "diked/impounded" Special Modifier classifies the influence of the levee on natural wetland function.

Construction Access Road Leading from Proposed Mitigation Site #1 to Horseshoe Pond and Vicinity

This area was surveyed for potential wetlands (Figure 5) on August 17th 2001. No wetlands were found in this area. Coyote brush scrub and coastal grassland composed the vegetation along the road corridor. A patch of spreading rush (*Juncus patens*; FAC) was found along the eastern end of the access road, approximately 500 feet west of the quarry. Spreading rush was associated with coyote brush (Baccharis pilularis; NI) shrubs and California blackberry (Rubus ursinus; FAC+). This site did not meet hydrophytic vegetation criteria of over 50% cover of FACW or OBL plant species. No indications of wetland hydrology or hydric soils were observed.

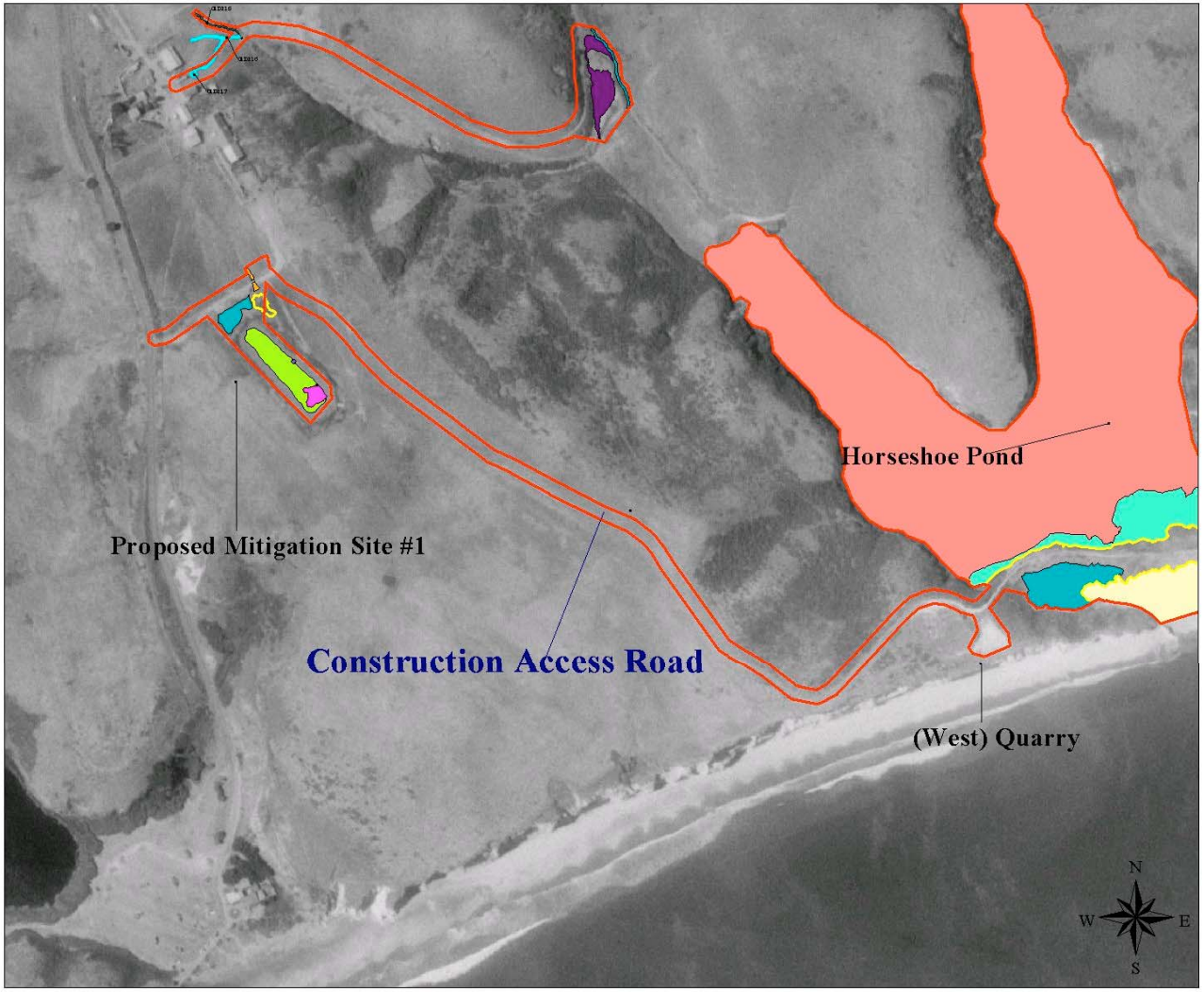
Proposed Mitigation Site #1: Former Manure Waste Pond, Surrounding Area, and Construction Access

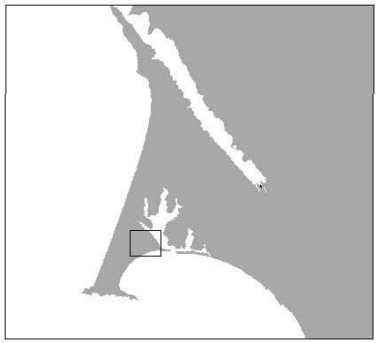
This sub-site is located approximately 200 yards south of the D Ranch complex along the construction access road (Figure 6). An abandoned waste pond, the dominant feature in this area, may be used as a mitigation site for California red-legged frog habitat. Following habitat enhancement efforts, including removal of contaminated topsoil, this site could provide suitable red-legged frog habitat that would mitigate potential negative impacts resulting from removal of the Horseshoe Pond levee. Soil in this area is classified as predominantly Sirdrak sand, 2 to 15 percent slope. A complete plant species list for this sub-site is provided in Appendix D.

PEMC (01DP06 and 01DP07) – 0.01 acres and 0.01 acres, respectively

- Palustrine, Emergent, Seasonally Flooded

Figure 5. Map of Construction Access Road Leading from Proposed Mitigation Site #1 to Horseshoe Pond and Vicinity; No Wetlands Found





Delineation Study Area
High Tide Line
Cowardin Delineations
E1UBLh
E2EMPh
E2SBPh
M2USP
PEMA
PEMB
PEMBxh
PEMC
PEMCh
PEMH
PUBChx
PUBFhx
PUBHhx
Cowardin Delineations
PEMA
PEMH

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This classification describes a small seasonally flooded depression at the base of a culvert that diverts surface flow under the construction access road. The vegetation cover is dominated by mouse barley (*Hordeum murinem*; NI) and perennial ryegrass (*Lolium perenne*; FAC). This wetland does not meet hydrophytic vegetation criteria of over 50% Cover of FACW or OBL plant species. When the wetland survey was conducted in late summer, the depression exhibited secondary indicators of wetland hydrology, including drift lines, sediment deposits, and a drainage pattern. Upon later inspection following a sustained period of precipitation, the site was observed to remain inundated with two inches of standing water for more than ten consecutive days. A soil sample was collected and soil matrix was analyzed by Munsell chart for soil hue, value and chroma. The Munsell notation for the soil was 10YR2/1.5. A low chroma of 1.5 indicates hydric conditions, so this wetland met hydric soil criteria for a wetland determination.

The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, emergents, mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean derived salts is below 0.5 ppt. Wetlands lacking such vegetation are also included if they exhibit all of the following characteristics: (1) are less than 8 hectares (20 acres); (2) do not have an active wave-formed or bedrock shoreline feature; (3) have at low water a depth less than 6.6 feet in the deepest part of the basin.

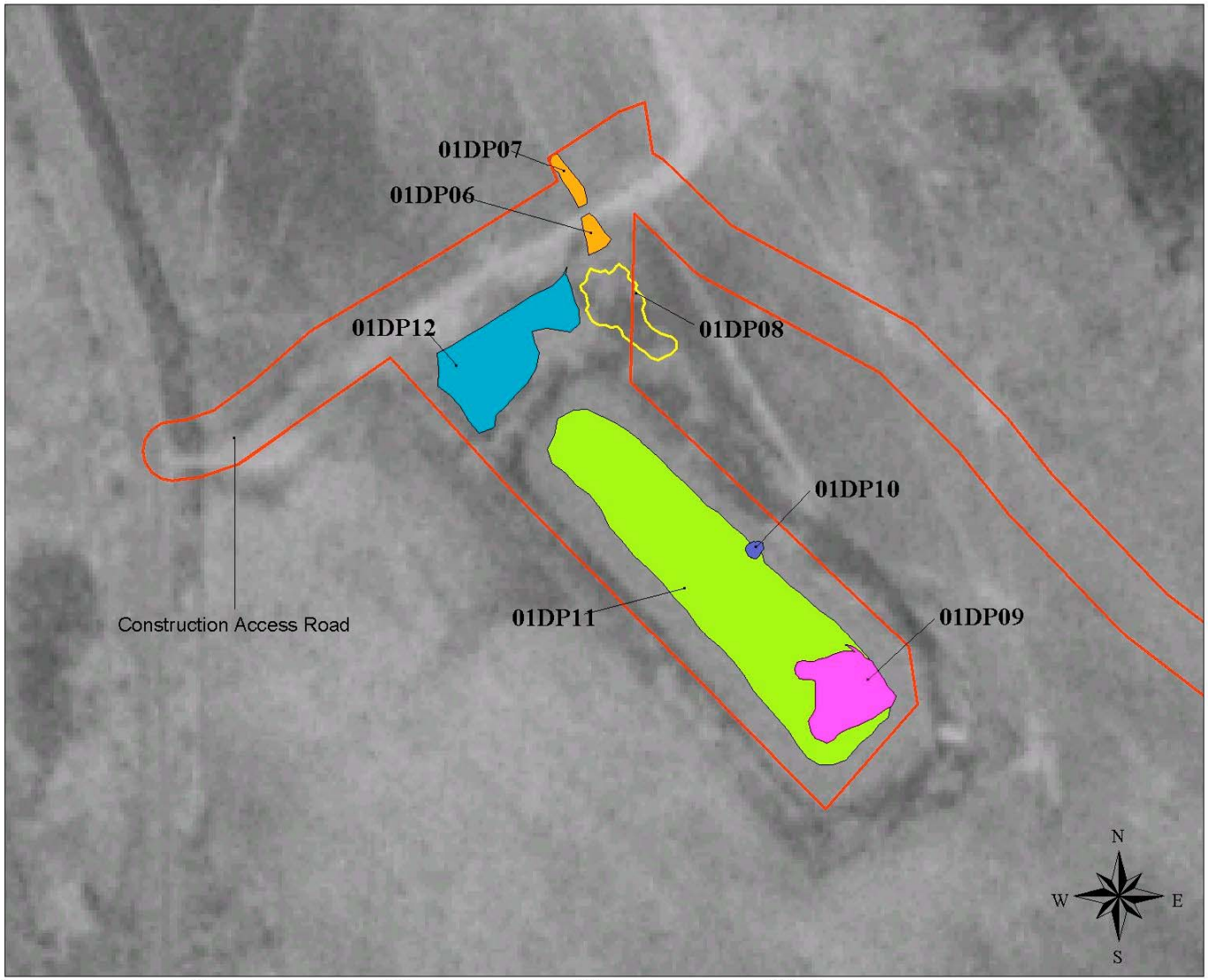
The Emergent Class is characterized by erect, rooted, perennial herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. The Seasonally Flooded Water Regime modifier indicates that the surface water is present for extended periods, but absent by the end of the growing season in most years. When surface water is absent the water table is usually at or very near the land surface.

PEMCh (01DP12) – 0.16 acres

- Palustrine Emergent, Seasonally Flooded, diked/impounded

This wetland is located behind (to the north of) a levee impounding the former sewage pond, along the construction access road to Horseshoe Pond. It is situated in a depression that seasonally floods from accumulation of surface water runoff and groundwater seepage. Surface water stands for over ten consecutive days, although the water table drops well below the ground surface during late summer months. Vegetation is composed of predominantly *Chenopodium*, sp., and *Lolium multiflorum*; NI, associated with minor components of annual rabbitsfoot grass (*Polypogon monspeliensis*; FACW) and spikerush (*Eleocharis macrostachya*; OBL). Because identification of the dominant plant species has not been determined, it is unclear whether this wetland meets hydrophytic vegetation criteria of over 50% cover of FACW or OBL plants. This wetland definitely meets hydrology criteria, exhibiting a primary hydrology indicator of standing water (two inches deep). The soil matrix was 10YR2/1.5. A low chroma of 1.5 indicates that the substrate was predominantly hydric. This wetland also meets hydric soil criteria for wetland determination.

Figure 6. Map of Cowardin Wetland Delineations at Proposed Mitigation Site #1: Former Manure Waste Pond, Surrounding Area, and Construction Access Road



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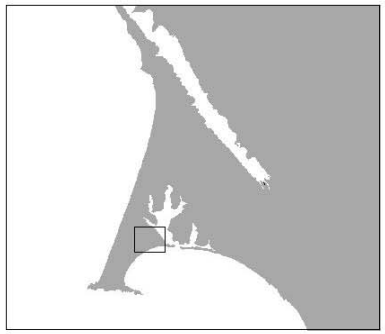
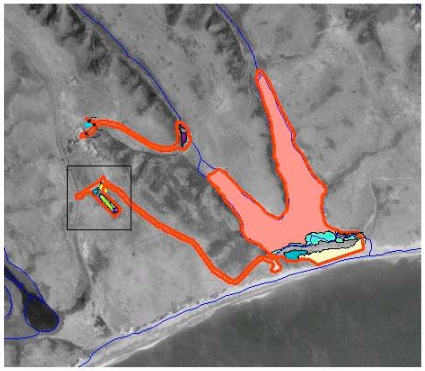




Delineation Study Area
High Tide Line
Cowardin Delineations
PEMB
PEMC
PEMCh
PUBChx (considered for classification, but rejected)
PUBFhx
PUBHhx
Cowardin Delineations
PEMA
PEMH

PEMB (01DP08) – 0.07 acres

- Palustrine, Emergent, Saturated

This area was initially determined to be a potential wetland based on its low-lying topographic position, in a depressional area. After an extended period of heavy precipitation, the site did not exhibit any indication of wetland hydrology, as was previously anticipated. Dominated by a pure stand of poison hemlock (*Conium maculatum*; FAC), the site does not meet hydrophytic vegetation criteria. The soil did not exhibit any hydric indicators. Although this site was initially mapped and classified, it was later determined not to be a wetland based on a reevaluation of wetland criteria.

PUBChx (01DP11) – 0.56 acres

- Palustrine, Unconsolidated Bottom, Seasonally Flooded, diked/impounded, excavated

This former sewage pond, a remnant from D Ranch dairy operations, is proposed as a potential mitigation site (Site #2) for California red-legged frog habitat. This Palustrine System intercepts groundwater levels and receives freshwater runoff from surrounding hillsides. When the site was surveyed on September 4th 2001, the substrate consisted of dry, cracked mud covered with mineral salt deposits, dried algal mats, and 35% vegetation cover. When the substrate dries during summer months, it is colonized by weedy annual forbs and grasses. The wetland was classified as Unconsolidated Bottom. This Class includes wetland habitats with at least 25% cover of particles smaller than stones, and a vegetation cover less than 30%. Although vegetation cover was estimated at over 30%, which would potentially classify the wetland as Emergent, the vegetation was non-persistent, annual, and predominantly non-hydrophytic. Vegetation would persist only in the absence of surface water inundation, for a short period at the end of summer. Vegetation includes *Chenopodium* sp., rabbitsfoot grass (*Polypogon monspeliensis*; FACW+), poison hemlock (*Conium maculatum*; FAC), and *Lolium multiflorum*; NI. This site did not meet hydrophytic vegetation criteria of greater than 50% cover. This portion of the pond dries up completely during summer months, yet clear evidence of hydrology was present, including saturation in the upper 12 inches of soil, drift lines, sediment deposits, and water marks/water stained leaves. Following extended periods of inundation, the water table remains near the ground surface; the water regime is classified as Seasonally Flooded. The soil exhibited hydric indicators, including high organic content, oxidized rhizospheres, and gleying. Two Special Modifiers were assigned to wetlands within the pond basin. "Diked/impounded" describes an artificial barrier obstructing the outflow and impounding the inflow of water and "excavated" describes the artificial creation of the pond basin.

PUBFhx (01DP10) – 0.01 acres

- Palustrine, Unconsolidated Bottom, Semi-permanently Flooded, diked/impounded, excavated

This tiny, seven foot diameter, pothole-shaped wetland is nested within a larger seasonally flooded (former) sewage pond basin (PUBChx; 01DP11). It was delineated and classified separately because the Water Regime Modifier is Semipermanently

Flooded. Standing water was observed at a depth of four inches. Surface water persists throughout the year in most years, but this wetland would dry up completely following successive drought years. Seven California red-legged frogs were observed in this wetland at the time of the wetland survey.

PUBHhx (01DP09) – 0.09 acres

- Palustrine, Unconsolidated Bottom, Permanently Flooded, diked/impounded, excavated

This portion of the sewage pond is permanently flooded. Measured at 30 feet in diameter with a standing water depth of three feet during late summer of a dry year, it is unlikely to dry up at any time. Green algal blooms, but no vegetation cover, was observed on the water surface.

Immediately Adjacent to (east of) D Ranch Complex

The following wetland delineations are located on an east-facing hillside that leads downslope from D Ranch buildings (Figure 7). This sub-site is situated along a construction access road that leads to an abandoned waste pond upstream from the west arm of Horseshoe Pond. Soil map units for this area are classified as predominantly Sirdrak sand, 2 to 15 percent slope. A complete plant species list for this sub-site is provided in Appendix E.

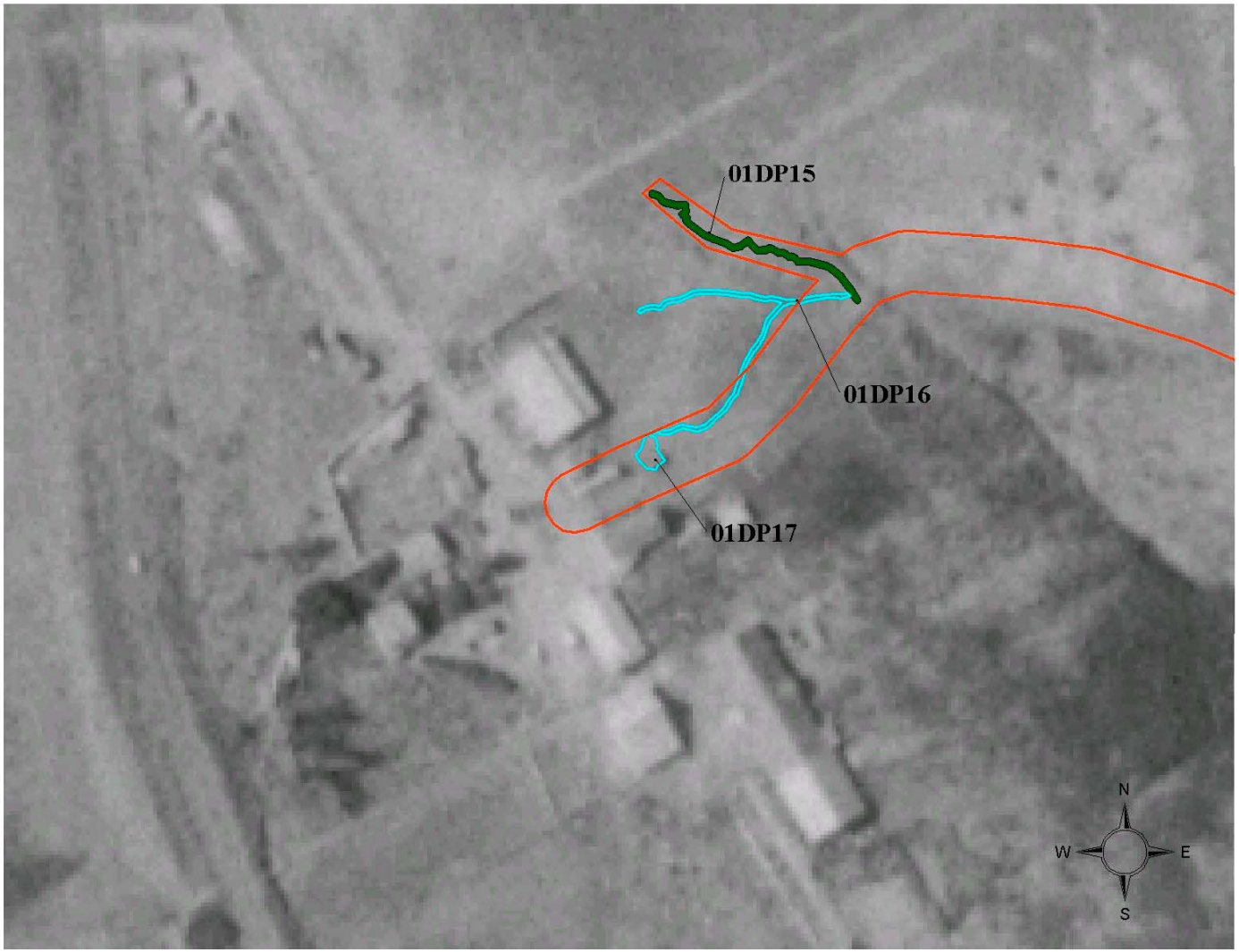
PEMA (01DP16 and 01DP17) – 0.03 acres and 0.01 acres, respectively

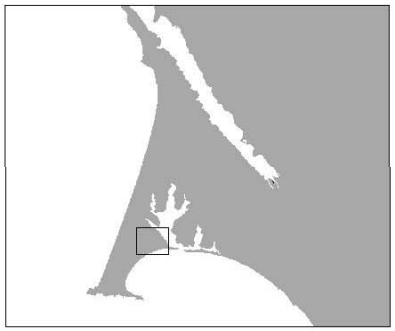
- Palustrine Emergent, Temporarily Flooded

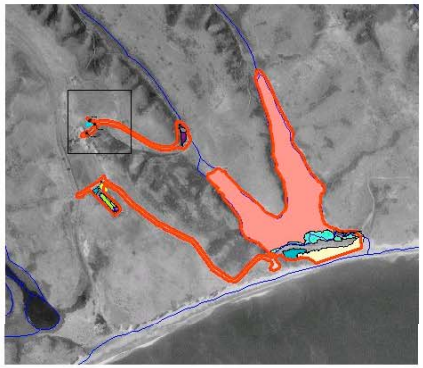
These small polygons are situated on a slope leading down from D Ranch, adjacent to the complex of buildings. An initial wetland determination of this site was made on September 4, 2001. Upon reevaluating wetland criteria during a later visit in November, it was determined that neither of these delineations qualified as wetlands.

The determination for 01DP17, a tiny ($35ft^2$) pothole-shaped wetland, was based on signs of hydrology and presence of hydrophytic vegetation cover. The presence of just over 50% cover of annual rabbitsfoot grass (*Polypogon monspeliensis*; FACW) met hydrophytic vegetation criteria for a wetland determination. No OBL plants were observed. A depressional feature was the main indicator of wetland hydrology. It appeared that surface water could stand for extended periods due to the low-lying topography (compared with surrounding area) and impermeability of the hardpan. In addition, the substrate exhibited "pavement" characteristics: a water-scoured hardpan with small pebble deposition along distinct flow patterns at the base of plants. No soil sample was collected and analyzed due to the impenetrable hardpan substrate that would unlikely exhibit any hydric features. A Y-shaped narrow gully connected by two channels (01DP16) was initially delineated based on a drainage pattern that appeared to indicate wetland hydrology. Satisfaction of this criterion was initially based on the presence of a physical, hydrogeomorphic feature.

Figure 7. Map of Cowardin Wetland Delineations East of D Ranch Building Complex







Project Boundary
Cowardin Delineations
PEMA
PEMH

0 40 80 Feet

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This site was revisited in November of 2001, following a month-long period of heavy rains that delivered approximately 15 inches of rain to the Project area. Contrary to what was expected based on the initial wetland assessment, no standing water was present in either polygon (01DP16 and 01DP17) and no other hydrology indicators, other than physical drainage patterns, were observed. In addition, the small patch of hydrophytic vegetation in 01DP17 was determined to occupy insignificant aerial cover. Physical hydrogeomorphic features observed in both polygons likely represent relict hydrology created by surface runoff that scoured the substrate during previous heavy storm events. Although the site exhibits evidence of relict hydrology, water does not appear to stand for long enough periods to create hydric soil conditions that would support significant hydrophytic vegetation cover.

PEMH (01DP15) – 0.03 acres

- Palustrine Emergent, Permanently Flooded

This severely eroded and incised gully with steep, vertical banks leads downslope from a five-foot deep headcut at the head of the drainage. This gully supports a low volume, perennial stream fed by a groundwater seep located just above the headcut. Disturbed vegetation structure and composition characterize this severely degraded habitat. The channel supports dense, overgrown mats of non-native perennial and annual grasses, weedy forbs, and a small native perennial grass component, growing among ranch debris deposited along the length of the gully. A small pool of standing water near the bottom of the gully supports a patch of non-native marsh pennywort (*Hydrocotyl ranunculoides*). A large pile of waste material, including scrap metal and a refrigerator, lies at the base of the gully.

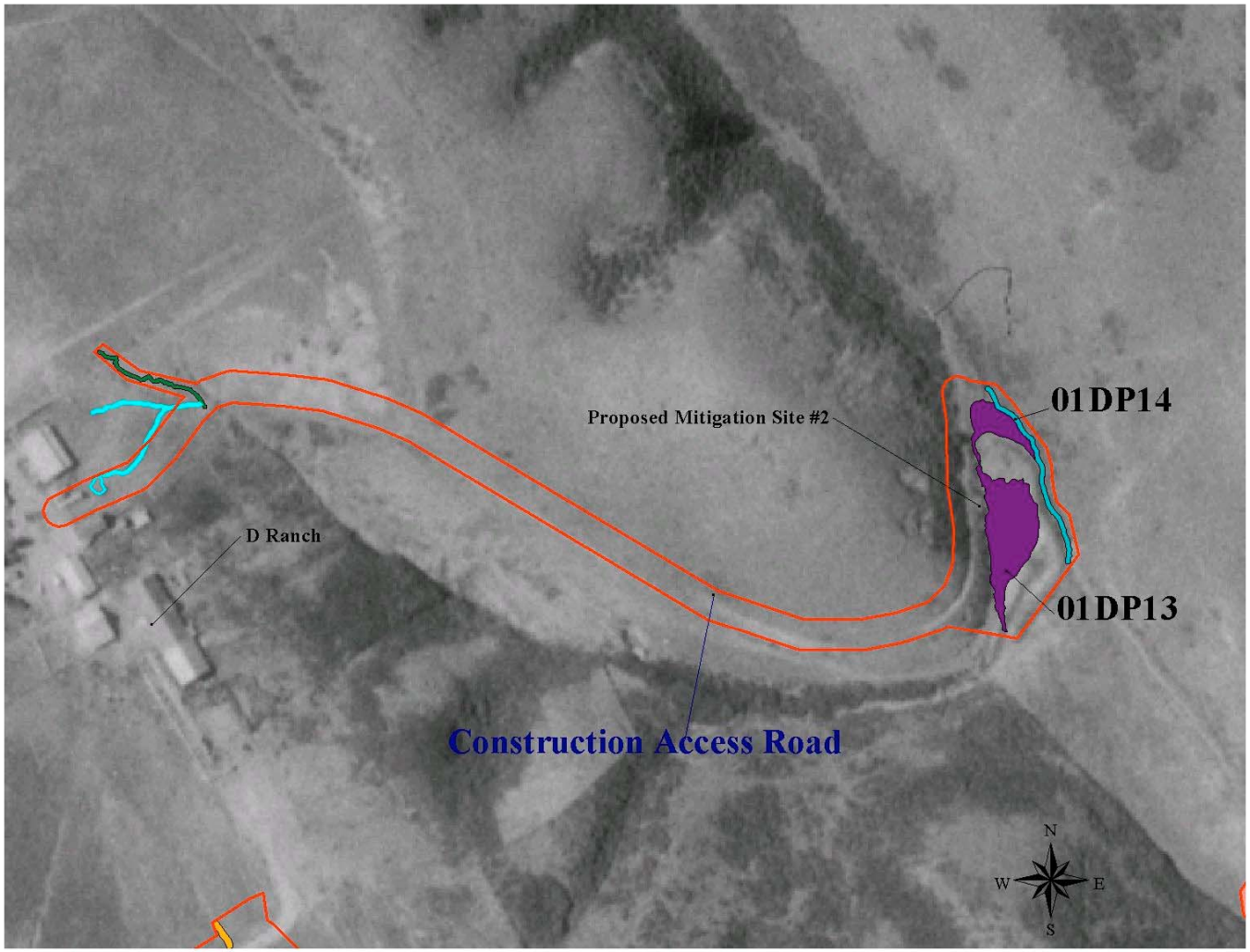
Construction Access Road Leading from D Ranch Complex to Proposed Mitigation Site #2.

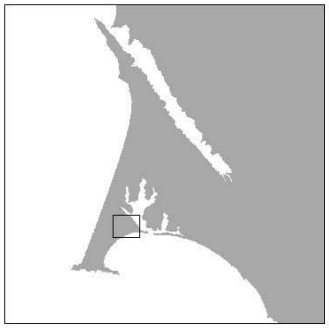
This area was surveyed for potential wetlands on August 17, 2001 (Figure 8). The habitat consisted of upland coastal grassland on a steep south-facing slope. No hydrophytic vegetation or indicators of wetland hydrology or hydric soils were observed along this road corridor.

Proposed Mitigation Site #2, approximately 400 yards north of west arm of Horseshoe Pond

This pond is a proposed mitigation site (Site #2) for impacts to California red-legged frog habitat associated with removal of dam and spillway material impounding Horseshoe Pond (Figure 9). These wetlands are situated on an alluvial fan deposited at the mouth of a major drainageway that empties into the northern end of the west arm of Horseshoe Pond. Soil map units characterizing this area are Humaquepts, seeped and Tomales-Sobega complex, 15 to 30 percent slopes. A complete plant species list for this sub-site is provided in Appendix F.

Figure 8 and 9. Map of Construction Access Road and Proposed Mitigation Site #2; No Wetlands Found on access road





Project Boundary
Cowardin Delineations
PEMBxh
PEMCh

0 60 120 180 240 Feet

S:\GIS\project1\horseshoe pond\cowardin wetlands

PEMBxh (01DP13) – 0.39 acres

- Palustrine, Emergent, Saturated, excavated, diked/impounded

This Palustrine Emergent wetland lies within a former waste pond, the second proposed mitigation site for California red-legged frog habitat. This area was excavated and impounded during the 1970's when it was utilized as a sewage pond for D Ranch dairy operations. The wetland habitat is severely degraded, evident by the disturbed vegetation composition. This site lacks a healthy, continuous cover of native hydrophytic vegetation which accounts for approximately 65% cover and is widely scattered throughout the wetland. A diverse mix of dense and matted layers of hydrophytic plants, upland weedy forbs, and non-native perennial grasses comprise the vegetation composition. No observable hydrology indicators were evident throughout a majority of the area. A small, narrow rill runs along the southeast corner of the wetland, along the base of the eroded levee. This rill holds standing water for brief periods during the winter season. Due to predominantly low obligate hydrophytic vegetation cover and a lack of hydrology indicators (with the exception of the rill) the site is likely saturated, but not flooded for more than ten consecutive days during the growing season. Two soil samples, revealing two different soil types, were collected within this wetland. One sample revealed poorly drained Humaquepts, seeped and the other a moderately well-drained Tomales-Sobega complex. This finding is not unusual, as the map unit for the Tomales-Sobega complex includes small areas of seeped Humaquepts in drainageways (Kashikawa, 1985). The mid- to upper 1/3 of the basin is completely dominated by a dense stand of poison hemlock. This area is situated at a slightly higher elevation than the surrounding wetland. It was excluded from the delineation, as it did not exhibit any wetland attributes.

PEMCh (01DP14) – 0.06 acres

- Palustrine, Emergent, Seasonally Flooded, diked/impounded

This Palustrine Emergent wetland is an intermittent stream confined to an incised stream channel. Its course is modified by a berm that binds the west stream bank. The channel widens out as it flows into a freshwater marsh that drains into the west arm of Horseshoe Pond. The water regime is seasonally flooded to semipermanently flooded during wetter years. The streambed is dominated by marsh parsley (*Oenanthe sarmentosa*; OBL). The stream banks support a variety of hydrophytic forbs and graminoids, including rush (*Juncus* spp.; FACW), spikerush (*Eloecharis macrostachya*; OBL), and cinquefoil (*Potentilla anserina*; OBL). Perennial non-native grasses including velvet grass (*Holcus lanatus*; FAC) and perennial ryegrass (*Lolium perenne*; FAC) are also growing along the stream bank. Although no standing water was present when the wetland assessment was conducted, a prevalence of obligate hydrophytic vegetation and signs of hydrology indicate recent inundation. Hydrology indicators included sediment deposits along the streambed, watermarks/water stained leaves, and matted, senescent vegetation likely resulting from recent water flow. A soil sample was collected and analyzed for Munsell hue, value, and chroma soil color: 10YR 3/2 matrix with 5YR 4/6 mottles. The presence of mottles within the soil matrix satisfies the hydric soil wetland criterion.

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Point Reyes National Seashore
Horseshoe Pond Restoration Project
Appendices

Appendix A. Field dataforms

Appendix B. List of Plant Species Observed Within Horseshoe Pond Restoration Project Area.

Species	**Common Name**	**Wetland Indicator Status**[1]
Abronia latifolia	coastal sand verbena	
Abronia umbellata ssp. *breviflora*	pink sand verbena	
Agrostis pallens	seashore bentgrass	UPL
Aira caryophyllea	silver hairgrass	NI
Ambrosia chamissonis	beach-bur	
Ammophila arenaria	European beachgrass	FACU
Anthemis cotula	stinking chamomile	FACU
Aster chilensis		FAC
Astragalus pycnostachyus var. *pycnostachyus*	marsh milkvetch	OBL
Atriplex leucophylla	beach saltbush	FAC*
Atriplex triangularis		
Baccharis pilularis	coyotebrush	
Bromus carinatus		
Cakile maritima	European searocket	FACW
Calystegia purpurata ssp. *purpurata*	Pacific false bindweed	
Carduus pycnocephalus	Italian plumeless thistle	
Carex obnupta	slough sedge	OBL
Carpobrotus edulis	hottentot fig	
Cirsium vulgare	bull thistle	FAC
Conium maculatum	poison hemlock	FAC
Cotula coronopifolia	common brassbuttons	FACW+
Cyperus eragrostis	tall flatsedge	FACW
Distichlis spicata	inland saltgrass	FACW
Dudleya farinosa	powdery liveforever	
Eleocharis macrostachya		OBL
Epilobium ciliatum ssp. *watsonii*	fringed willowherb	FACW
Erechtites glomerata	cutleaf burnweed	
Erechtites minima	coastal burnweed	
Eriogonum latifolium	seaside buckwheat	
Festuca arundinacea		FAC-
Foeniculum vulgare	sweet fennel	FACU-
Glyceria occidentalis	northwestern mannagrass	OBL
Gnaphalium canescens ssp. *beneolens*		FACU*
Gnaphalium palustre	western marsh cudweed	FACW
Gnaphalium sp.		
Helenium puberulum	rosilla	FACW
Holcus lanatus	common velvetgrass	FAC
Hordeum brachyantherum	meadow barley	FACW

[1] Wetland status of plant species based on Reed (1996). See Table 1 for explanation.

Appendix B (cont.). List of Plant Species Observed Within Entire Horseshoe Pond Restoration Project Area.

Species	Common Name	Wetland Indicator Status[1]
Hordeum murinum	mouse barley	
Hypochaeris radicata	hairy catsear	FACU*
Iris douglasiana	Douglas iris	
Jaumea carnosa	marsh jaumea	OBL
Juncus balticus	Baltic rush	FACW+
Juncus effusus var. *brunneus*	rush	FACW+
Juncus lesueurii	salt rush	FACW
Juncus patens	spreading rush	FAC
Leymus mollis ssp. *mollis*	American dunegrass	UPL
Leymus triticoides	beardless wildrye	FAC+
Lolium multiflorum		
Lolium perenne	perennial ryegrass	FAC*
Lotus corniculatus	birdfoot deervetch	FAC
Lotus heermannii var. *orbicularis*	Heermann's bird's-foot trefoil	
Lythrum hyssopifolia	hyssop loosestrife	FACW
Malva parviflora	cheeseweed mallow	
Melilotus indica	annual yellow sweetclover	FAC
Oenanthe sarmentosa	water parsely	OBL
Paspalum dilatatum	dallisgrass	FAC
Phalaris sp.	canarygrass	
Plantago lanceolata	narrowleaf plantain	FAC-
Plantago subnuda	tall coastal plantain	FACW+
Polypogon monspeliensis	annual rabbitsfoot grass	FACW+
Potentilla anserina ssp. *pacifica*		OBL
Raphanus sativus	cultivated radish	UPL
Rorippa nasturtium-aquaticum	watercress	OBL
Rubus ursinus	California blackberry	FAC+
Rumex acetosella	common sheep sorrel	FAC-
Rumex conglomeratus	clustered dock	FACW
Rumex crispus	curly dock	FACW-
Rumex salicifolius var. *crassus*	willow dock	OBL
Ruppia sp.	widgeonweed	OBL
Salicornia virginica	Virginia glasswort	OBL
Scirpus californicus		OBL
Scirpus maritimus		OBL
Scirpus pungens		OBL
Silybum marianum	blessed milkthistle	
Sonchus asper	spiny sowthistle	FAC
Spergularia macrotheca var. *macrotheca*	sticky sandspurry	FAC+
Spergularia rubra	red sandspurry	FAC-

[1] Wetland status of plant species based on Reed (1996). See Table 1 for explanation.

Appendix B (continued). List of Plant Species Observed Within Horseshoe Pond Restoration Project Area.

Species	**Common Name**	**Wetland Indicator Status**[1]
Stachys ajugoides	hedgenettle	OBL
Stellaria littoralis	beach starwort	OBL
Trifolium repens	white clover	FAC
Trifolium sp.	unknown clover	
Trifolium variegatum	whitetip clover	FACW-
Triglochin concinna var. *concinna*	Utah arrowgrass	OBL
Urtica dioica		FACW
Veronica americana	American speedwell	OBL
Vulpia bromoides	brome fescue	FACU*

[1] Wetland status of plant species based on Reed (1996). See Table 1 for explanation.

Appendix C. List of Plant Species Observed Along Oceanside (South) Shoreline of Horseshoe Pond.

Species	**Common Name**	**Wetland Indicator Status1**
Abronia latifolia	coastal sand verbena	NI
Abronia umbellata ssp. *breviflora*	pink sand verbena	NI
Agrostis pallens	seashore bentgrass	UPL
Aira caryophyllea	silver hairgrass	NI
Ambrosia chamissonis	beach-bur	NI
Ammophila arenaria	European beachgrass	FACU
Astragalus pycnostachyus var. *pycnostachyus*	marsh milkvetch	OBL
Atriplex leucophylla	beach saltbush	FAC*
Atriplex triangularis		NI
Baccharis pilularis	coyotebrush	NI
Cakile maritima	European searocket	FACW
Carex obnupta	slough sedge	OBL
Carpobrotus edulis	hottentot fig	NI
Cirsium vulgare	bull thistle	FAC
Cotula coronopifolia	common brassbuttons	FACW+
Distichlis spicata	inland saltgrass	FACW
Dudleya farinosa	powdery liveforever	NI
Eleocharis macrostachya		OBL
Erechtites glomerata	cutleaf burnweed	NI
Erechtites minima	coastal burnweed	NI
Eriogonum latifolium	seaside buckwheat	NI
Gnaphalium palustre	western marsh cudweed	FACW
Gnaphalium sp.		NI
Holcus lanatus	common velvetgrass	FAC
Hordeum brachyantherum	meadow barley	FACW
Hypochaeris radicata	hairy catsear	FACU*
Jaumea carnosa	marsh jaumea	OBL
Juncus lesueurii	salt rush	FACW
Juncus patens	spreading rush	FAC
Leymus mollis ssp. *mollis*	American dunegrass	UPL
Leymus triticoides	beardless wildrye	FAC+
Lolium perenne	perennial ryegrass	FAC*
Lotus corniculatus	birdfoot deervetch	FAC
Lotus heermannii var. *orbicularis*	Heermann's bird's-foot trefoil	NI
Paspalum dilatatum	dallisgrass	FAC
Plantago lanceolata	narrowleaf plantain	FAC-
Plantago subnuda	tall coastal plantain	FACW+
Polypogon monspeliensis	annual rabbitsfoot grass	FACW+

[1] Wetland status of plant species based on Reed (1996). See Table 1 for explanation.

Appendix C (continued). List of Plant Species Observed Along Oceanside (South) Shoreline of Horseshoe Pond.

Species	**Common Name**	**Wetland Indicator Status1**
Potentilla anserina ssp. *pacifica*		OBL
Rubus ursinus	California blackberry	FAC+
Rumex acetosella	common sheep sorrel	FAC-
Rumex conglomeratus	clustered dock	FACW
Rumex crispus	curly dock	FACW-
Rumex salicifolius var. *crassus*	willow dock	OBL
Salicornia virginica	Virginia glasswort	OBL
Scirpus californicus		OBL
Scirpus maritimus		OBL
Scirpus pungens		OBL
Sonchus asper	spiny sowthistle	FAC
Spergularia macrotheca var. *macrotheca*	sticky sandspurry	FAC+
Stellaria littoralis	beach starwort	OBL
Trifolium sp.	unknown clover	
Triglochin concinna var. *concinna*	Utah arrowgrass	OBL
Vulpia bromoides	brome fescue	FACU*

[1] Wetland status of plant species based on Reed (1996). See Table 1 for explanation.

Appendix D. List of Plant Species Observed at Proposed Mitigation Site #1 and Surrounding Area

Full Species Name	**Common Name**	**Wetland Indicator Status1**
Atriplex triangularis		NI
Cirsium vulgare	bull thistle	FAC
Conium maculatum	poison hemlock	FAC
Eleocharis macrostachya		OBL
Foeniculum vulgare	sweet fennel	FACU-
Glyceria occidentalis	northwestern mannagrass	OBL
Hordeum murinum	mouse barley	NI
Juncus balticus	Baltic rush	FACW+
Lolium multiflorum		NI
Lolium perenne	perennial ryegrass	FAC*
Malva parviflora	cheeseweed mallow	NI
Polypogon monspeliensis	annual rabbitsfoot grass	FACW+
Raphanus sativus	cultivated radish	UPL

[1] Wetland status of plant species based on Reed (1996). See Table 1 for explanation.

Appendix E. List of Plant Species Observed Near D Ranch Building Complex.

Species	**Common Name**	**Wetland Indicator Status1**
Anthemis cotula	stinking chamomile	FACU
Bromus carinatus		
Carduus pycnocephalus	Italian plumeless thistle	
Cirsium vulgare	bull thistle	FAC
Festuca arundinacea		FAC-
Holcus lanatus	common velvetgrass	FAC
Hordeum murinum	mouse barley	
Juncus patens	spreading rush	FAC
Lolium multiflorum		
Lythrum hyssopifolia	hyssop loosestrife	FACW
Melilotus indica	annual yellow sweetclover	FAC
Polypogon monspeliensis	annual rabbitsfoot grass	FACW+
Raphanus sativus	cultivated radish	UPL
Rorippa nasturtium-aquaticum	watercress	OBL
Sonchus asper	spiny sowthistle	FAC
Spergularia rubra	red sandspurry	FAC-
Trifolium repens	white clover	FAC
Vulpia bromoides	brome fescue	FACU*

[1] Wetland status of plant species based on Reed (1996). See Table 1 for explanation.

Appendix F. List of Plant Species Observed at Proposed Mitigation Site #2

Species	**Common Name**	**Wetland Indicator Status1**
Aster chilensis		FAC
Atriplex triangularis		NI
Baccharis pilularis	coyotebrush	NI
Calystegia purpurata ssp. *purpurata*	Pacific false bindweed	NI
Cirsium vulgare	bull thistle	FAC
Conium maculatum	poison hemlock	FAC
Cotula coronopifolia	common brassbuttons	FACW+
Cyperus eragrostis	tall flatsedge	FACW
Eleocharis macrostachya		OBL
Epilobium ciliatum	fringed willowherb	NI
Festuca arundinacea		FAC-
Glyceria occidentalis	northwestern mannagrass	OBL
Gnaphalium canescens ssp. *beneolens*		FACU*
Helenium puberulum	rosilla	FACW
Holcus lanatus	common velvetgrass	FAC
Hordeum brachyantherum	meadow barley	FACW
Hordeum murinum	mouse barley	NI
Iris douglasiana	Douglas iris	NI
Juncus balticus	Baltic rush	FACW+
Juncus effusus var. *brunneus*	lamp rush	FACW
Juncus patens	spreading rush	FAC
Lolium multiflorum		NI
Lolium perenne	perennial ryegrass	FAC*
Lotus corniculatus	birdfoot deervetch	FAC
Oenanthe sarmentosa	water parsely	OBL
Phalaris sp.	canarygrass	NI
Plantago lanceolata	narrowleaf plantain	FAC-
Polypogon monspeliensis	annual rabbitsfoot grass	FACW+
Potentilla anserina ssp. *pacifica*		OBL
Raphanus sativus	cultivated radish	UPL
Rubus ursinus	California blackberry	FAC+
Rumex conglomeratus	clustered dock	FACW
Silybum marianum	blessed milkthistle	NI
Stachys ajugoides	hedgenettle	OBL
Trifolium variegatum	whitetip clover	FACW-
Urtica dioica		FACW
Veronica americana	American speedwell	OBL

[1] Wetland status of plant species based on Reed (1996). See Table 1 for explanation.

Appendix G. Description of National Wetlands Inventory (NWI) Mapping Codes.

SYSTEM	SUBSYSTEM	NWI CODE
Marine	Subtidal	M1
	Intertidal	M2
Estuarine	Subtidal	E1
	Intertidal	E2
Palustrine	--	P
Lacustrine	Limnetic	L1
	Littoral	L2
Riverine	Tidal	R
	Lower Perennial	LP
	Upper Perennial	UP
	Intermittent	I

CLASS	NWI CODE
Rock Bottom	RB
Unconsolidated Bottom	UB
Aquatic Bed	AB
Reef	RF
Unconsolidated Shore	US
Rocky Shore	RS
Streambed	SB
Moss-Lichen Wetland	ML
Emergent Wetland	EM
Scrub-shrub Wetland	SS
Forested Wetland	FO

WATER REGIME	NWI CODE
Tidal	
Subtidal	L
Irregularly Flooded	M
Regularly Flooded	N
Irregularly Flooded	P
Temporarily Tidal	S
Seasonal Tidal	R
Semi-permanently Tidal	T
Permanent Tidal	V
Non-Tidal	
Temporarily Flooded	A
Saturated	B
Seasonally Flooded	C
Semi-permanently Flooded	F
Intermittently Exposed	G
Permanently Flooded	H
Intermittently Flooded	J
Artificially Flooded	K
Intermittently Flooded/Temp	W
Saturated/Semipermanently/Seasonally Flooded	Y
Intermittently Exposed/Permanently Flooded	Z
Unknown	U

SPECIAL MODIFIERS	NWI CODE
Beaver	b
Partially drained/Ditched	d
Farmed	f
Diked/Impounded	h
Artificial Substrate	r
Spoil	s
Excavated	x
Grazed	g

Appendix H. Chart Illustrating Hierarchical Structure of USFWS Cowardin Wetland Classification System.

SYSTEM-SUBSYSTEM-CLASS CHART

SYSTEM	Marine (M)		Estuarine (E)		Riverine (R)				Lacustrine (L)		Palustrine (P)
SUB-SYSTEMS	1 ST	2 IT	1 ST	2 IT	1 T	2 LP	3 UP	4 I	1 LIM	2 LIT	--
CLASSES											
RB	X		X		X	X	X		X	X	X
UB	X		X		X	X	X		X	X	X
AB	X	X	X	X	X	X	X		X	X	X
RF	X	X	X	X							
US		X		X	X	X	X			X	X
RS		X		X	X	X	X			X	
SB				X	X			X			
ML											X
EM				X	X	X				X	X
SS				X							X
FO				X							X

CLASS DESCRIPTION

NWI CODE	CLASS NAME	DESCRIPTION
RB	Rock bottom	Over 75% cover of stones, boulders, or bedrock and < 30% veg cover.
UB	Unconsolidated bottom	At least 25% cover of particles smaller than stones and < 30% veg cover.
AB	Aquatic bed	Dominated by plants that grow on or below the surface water in most years.
RF	Reef	Ridge/mound-like structures dominated by colonized sedentary invertebrates.
US	Unconsolidated shore	Must have: 1) unconsolidated substrate with < 75% cover of stones boulders or bedrock, 2) veg cover < 30%, and 3) saturated, irregularly exposed, or regularly, irregularly, seasonal, intermit, temp, or artificially flooded.
RS	Rocky shore	Over 75% cover of bedrock, stones or boulders and < 30% veg cover.
SB	Streambed	Vary greatly in substrate and for. Most have little to no veg cover due to scouring.
ML	Moss-lichen wetland	Veg cover < 30% and mosses or lichens cover substrates other than rock.
EM	Emergent wetland	Erect, rooted, herbaceous hydrophytes present most of growing season in most years.
SS	Scrub-shrub wetland	Dominant veg is woody plants < 6m (20 feet) tall.
FO	Forested wetland	Dominant veg is woody plants > 6m (20 feet) tall.

WATER REGIMES AND CLASSES

NON TIDAL	RB	UB	AB	RF	US	RS	SB	ML	EM	SS	FO
H (Perm. Flooded)	X	X	X						X	X	X
G (Intermitt. Exposed)	X	X	X						X	X	X
F (Semiperm. Flooded)	X	X	X						X	X	X
C (Seasonally Flooded)			X		X	X	X		X	X	X
B (Saturated)					X			X	X	X	X
A (Temp. Flooded)					X	X	X		X	X	X
J (Intermitt. Flooded)					X	X	X		X	X	X

Appendix H (continued)**.** Chart Illustrating Hierarchical Structure of USFWS Cowardin Wetland Classification System.

WATER REGIMES AND CLASSES

SALTWATER TIDAL	**RB**	**UB**	**AB**	**RF**	**US**	**RS**	**SB**	**ML**	**EM**	**SS**	**FO**
L (Subtidal)	X	X	X	X							
M (Irregularly Exposed)			X	X	X	X	X			X	X
N (Regularly Flooded)			X	X	X	X	X		X	X	X
P (Irregularly Flooded)				X	X	X	X		X	X	X
FRESHWATER TIDAL											
S (Temp-Tidal)					X	X	X		X	X	X
R (Seasonal-Tidal)			X		X	X	X		X	X	X
T (Semiperm-Tidal)	X	X	X						X	X	X
V (Perm.- Tidal)	X	X	X						X	X	X
K (Artificially Flooded)	X	X	X	X	X	X	X	X	X	X	X

WATER REGIME MODIFIER DESCRIPTION

(year-round growing season)

Tidal	**Description**
L (Subtidal)	Permanently flooded with tidal water.
M (Irregularly Exposed)	Land surface exposed by tides less often than daily.
N (Regularly Exposed)	Tidal water alternately floods and exposes the land surface at least once daily.
P (Irregularly Flooded)	Tidal water floods the land surface less often than daily.
K (Artificially Flooded)	Duration of flooding is controlled by artificial means (i.e. pumps, siphons, dikes, dams, etc.)

Non-Tidal	
A (Temp. Flooded)	Surface water is present for brief periods during the year.
B (Saturated)	Surface water is seldom present, but substrate is saturated to the surface for extended periods.
C (Seasonally Flooded)	Surface water is present for extended periods, especially after seasonal rainfall and/or runoff.
H (Perm. Flooded)	Land inundated throughout year in all years. Vegetation consists of obligate wetland plants.
F (Semiperm. Flooded)	Surface water persists throughout the year in most years.
G (Intermitt. Exposed)	Surface water present throughout the year except in extreme drought.
J (Intermitt. Flooded)	Substrate usually exposed, but surface water is present for variable periods w/o detectable seasonal periodicity.
K (Artificially Flooded)	Duration of flooding is controlled by artificial means (i.e. pumps, siphons, dikes, dams, etc.)

SPECIAL MODIFIERS

b- Beaver	d- Partially Drained/ Ditched	f- Farmed	h- Diked/ Impounded	r- Artificial Substrate	s- Spoil	x- Excavated